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Perforated Diverticulitis Treated With Primary Resection And Anastomosis In A 34-Year-Old Patient: A Case Report.

Nikolaos Tepelenis [1], Stefanos K Stefanou[2], Christos K. Stefanou[3], Kostas Tepelenis [4*], Maria Alexandra Kefala [5], PeriklisTsoumanis[6], Dimitris Tsoumanis[7], George Gogos-Pappas [4], Konstantinos Vlachos [4].

[1]*Department of Pathology, Agia Sofia Children's Hospital, Athens, 11527, Greece.*
[2] *Department of Surgery, General Hospital of Ioannina "G. Xatzikosta", Ioannina, 45500, Greece.*
[3] *Department of Surgery, General Hospital of Filiates, Filiates, 46300, Greece.*
[4]*Department of Surgery, University Hospital of Ioannina, Ioannina, 45500, Greece.*
[5] *Pediatrician, Ioannina, 45500, Greece.*
[6]*Department ofOphthalmology,University Hospital of Ioannina, Ioannina, 45500, Greece.*
[7] *Department of Orthopedics, University Hospital of Ioannina, Ioannina, 45500, Greece.*
Corresponding author: Kostas Tepelenis MD, MSc
Address: Vellas 30, Kardamitsia, Ioannina, Greece

Abstract
Background: *The optimal surgical approach for perforated diverticulitis has been controversial. Most surgeons prefer the Hartmann procedure for managing diffuse peritonitis due to perforated diverticulitis.*
Case presentation: *Herein, we report a 34-year-old male who appeared in the emergency department with a history of diffuse abdominal pain in the previous 24 hours, associated with fever, nausea, and vomiting. Clinical examination revealed peritonitis with muscle rigidity, which was confirmed by abdominal computed tomography. A perforated diverticulum of the sigmoid colon and free pus in the abdomen were identified during the exploratory laparotomy. A sigmoidectomy with primary anastomosis without diverting loop ileostomy was performed.*
Conclusion: *Hartmann procedure has been considered the procedure of choice for managing diffuse peritonitis due to perforated diverticulitis in critically ill patients and selected patients with multiple comorbidities. Primary resection anastomosis with or without diverting loop ileostomy should be considered in clinically stable patients with no comorbidities.*

Keywords: *Diverticulitis; Peritonitis; Hinchey classification; Hartmann procedure; Primary resection anastomosis; Laparoscopic lavage.*

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I. Introduction

Acute diverticulitis is a widespread gastrointestinal disease linked with significant morbidity and health care costs (1). It is estimated that there are more than 2.7 million visits to outpatients' clinics and 200,000 admissions for diverticulitis at the expense of $2.1 billion (2). The reported incidence is <20% at age 40, which rises to 60% by age 60 (3).

The reported lifetime risk of diverticulitis in a person with diverticulosis is 4%. Diverticulitis is divided into complicated and uncomplicated forms (4). Almost 12% of patients with diverticulitis will develop complications. The most frequent complication is phlegmon or abscess (70%), followed by peritonitis, obstruction, and fistula (5).

The treatment of diverticulitis depends on whether the disease is complicated or uncomplicated. Patients with perforated diverticulitis (purulent or fecal peritonitis) require urgent surgical intervention. There are two surgical approaches: colonic resection with the construction of an end colostomy (Hartmann procedure) and primary resection anastomosis (PRA) with or without diverting loop ileostomy. There is currently much debate about the optimal surgical approach. Generally, guidelines recommend the Hartmann procedure in critically ill patients or patients with multiple comorbidities and PRA with or without diverting loop ileostomy in clinically stable patients with no comorbidities. Laparoscopic lavage has been proposed as an alternative to colonic resection in patients with diffuse peritonitis due to perforated diverticulitis as it has the potential benefit

of avoiding a stoma in such patients. However, it should be performed only in very selected patients with generalized peritonitis and should not consider the first-line treatment in patients with diverticular peritonitis (6, 7). Here we report the case of a 34-year-old male who was diagnosed with diffuse peritonitis due to perforated diverticulitis (Hinchey III) and treated with primary resection anastomosis without diverting loop ileostomy.

II. Case Presentation

A 34-year-old male visited the emergency department with a history of diffuse abdominal pain in the previous 24 hours, with fever, nausea, and vomiting. The patient's medical history was unremarkable. Vital signs were as follows: blood pressure (BP) 120/75 mmHg, heart rate (HR) 100/min, respiratory rate (RR) 18/min, SO2 98%, and temperature (T) 38.4 °C.

Abdominal examination disclosed peritonitis with muscle rigidity. Laboratory studies revealed elevated white blood cells (17.00K/Ul), neutrophils (90%), and C – reactive protein (315 mg/L). Abdominal computed tomography showed free air in the abdomen, diverticula of the sigmoid colon, adjacent fat stranding, and extraluminal fluid collection in the left iliac fossa. All these findings were in keeping with perforated sigmoid diverticulitis.

Exploratory laparotomy was performed through a midline incision. A perforated diverticulum of the sigmoid colon and free pus in the abdomen were identified. A sigmoidectomy with primary anastomosis without diverting loop ileostomy was carried out as the patient was clinically stable without comorbidities. The postoperative period was uneventful, and the patient was discharged on the 7th postoperative day. Histopathologic findings confirmed the diagnosis of perforated diverticulitis: perforated diverticulum in the antimesenteric border of the colon with a complete rupture of the colon wall, acute and chronic inflammatory infiltration, focal necrosis, capillary dilatation of capillaries and hemorrhage in the serosa and subserosa.

III. Discussion

Diverticular disease is one of the most typical gastrointestinal disorders. Although it happens more frequently in Western countries, diverticular disorder continues to rise worldwide. In the United States of America, acute diverticulitis is the most commonly listed gastrointestinal diagnosis in outpatients' clinics and the emergency department (1). Annually, there are more than 2.7 million visits to outpatients' clinics and 200,000 admissions for diverticulitis at the cost of $2.1 billion (2). The incidence of diverticulosis is age-dependent and ranges from <20% at age 40 to 60% by age 60 (3). The estimated prevalence of diverticulosis in the United States of America is 180 cases/100,000 persons per year (4). Diverticulitis is more common in men until the 6th decade of life when it becomes more common in women (2).

In the past, the reported lifetime risk of diverticulitis in a person with diverticulosis ranged from 10% to 25% (2). Nowadays, 4% of individuals with diverticula will develop diverticulitis throughout their lifetime. Diverticulitis is divided into uncomplicated and complicated forms. According to the modified Hinchey classification, there are five different categories:

- Stage 0: Mildclinicaldiverticulitis
- Stage I: Pericolic phlegmon (Ia) or pericolic abscess (Ib)
- Stage II: Pelvic, intra-abdominal, or retrocolic abscess
- Stage III: Generalizedpurulentperitonitis
- Stage IV: Generalized fecal peritonitis (4)

Approximately 12% of patients with diverticulitis will develop complications. The most typical complication is phlegmon or abscess (70%), followed by peritonitis, obstruction, and fistula. The risk of recurrence increases as more episodes of acute diverticulitis occurs. After a first episode, the risk is 8% at one year and 20% at ten years, which rises to 18% at one year and 55% at ten years after a second episode. After a third episode, the risk is 40% at three years (5).

The optimal treatment of diverticulitis depends on whether the disease is complicated or uncomplicated. All guidelines suggest that outpatient treatment is safe and efficient for patients with uncomplicated diverticulitis without significant comorbidities, who can tolerate oral intake and manage themselves at home or have adequate family support. A reevaluation within seven days is also recommended. In case of clinical deterioration, reevaluation should be performed earlier. Patients with severe comorbidities or who cannot take fluids orally should be treated as inpatients with intravenous fluids. Antibiotics should be administered selectively on a case-by-case basis (6, 7).

It is estimated that 15-20% of patients admitted with diverticulitis have an abscess on computed tomography (8). Patients with small abscesses (<4-5) cm should be treated conservatively with antibiotics (6, 7). The non-operative approach is safe and efficient in these patients, with a reported pooled failure rate of 20% and a mortality rate of 0.6% (9). For larger abscesses, antibiotics might fail to reach the adequate concentration resulting in an increased failure rate. Therefore, percutaneous drainage combined with antibiotics is optimal for large abscesses (>4-5 cm). If percutaneous drainage of the abscess is not feasible or available, the treatment

depends on the patients' clinical condition. For patients in good clinical condition, antibiotic therapy alone is recommended. Otherwise, surgical intervention is required (6, 7).

Patients with diffuse peritonitis and sepsis (Hinchey III and IV) should receive fluid resuscitation, antibiotic administration, and urgent surgical intervention. A controversy exists over the preferred surgical approach. The options include colonic resection with the construction of an end colostomy (Hartmann procedure) and primary resection anastomosis (PRA) with or without diverting loop ileostomy. In critically ill patients or patients with multiple comorbidities, guidelines recommend the Hartmann procedure. In clinically stable patients with no comorbidities, PRA is the recommended surgical intervention (6, 7).

Several meta-analyses have been conducted to enlighten which of the two procedures (Hartmann procedure vs PRA with or without diverting loop ileostomy) in patients with perforated diverticulitis (Hinchey III and Iva) has a more favorable outcome and to compare the advantages between the two forms of treatment. When considering observational studies, mortality and morbidity were lower after PRA (11, 12). But if we consider only RCTs, there was no difference in mortality and morbidity between the two procedures (11-13). Only in one meta-analysis, the morbidity was lower after PRA when considering observational studies (13). During follow-up, all meta-analyses demonstrated that patients undergoing PRA were more likely to be stoma-free and had a lower rate of reversal-related morbidity (10, 12, 13).l

In 2018, Acuna et al. conducted a systematic review and meta-analysis of six randomized controlled trials (RCTs). No convincing differences were observed in mortality and significant complications when comparing patients undergoing PRA with those undergoing the Hartmann procedure. At 12 months after initial surgery, patients undergoing PRA were more likely to be stoma-free (85.6% vs 60.9%) and displayed a lower rate of reversal-related severe morbidity (13% vs 3%) (10).

One year later, the meta-analysis of Halim et al. was published. It was composed of 25 studies, of which 22 were observational, and 3 were RCTs. The overall mortality in patients undergoing the Hartmann procedure was 10.8% in the observational studies and 9.4% in the RCTs. The mortality rates of patients undergoing PRA were 8.2% in the observational studies and 4.3% in the RCTs. The meta-analysis of the observational studies displayed a 40% lower mortality rate in patients undergoing PRA, while the meta-analysis of RCTs did not show a statistically significant difference in mortality between the two procedures. Wound infection rates between the two groups were comparable (11).

In 2020, Lambrichts et al. appraised mortality, morbidity, reversal rates of constructed stomas, number of stoma-free patients, and reversal-related morbidity based on four RCTs, three prospective studies, and seven retrospective observational studies. The meta-analysis of RCTs did not demonstrate any difference in mortality between the Hartmann procedure and PRA, whereas the meta-analysis of observational studies showed lower PRA mortality compared to the Hartmann procedure (12.3% vs 29.2%). No difference was observed regarding the morbidity. During follow-up, patients undergoing PRA were more likely to be stoma-free (83.8% vs 62.3%) and showed a lower rate of reversal-related morbidity (12)

Recently, Bezerra et al. meta-analyze 17 observational studies and 4 RCTs. Mortality and morbidity were lower after PRA when only observational studies were included in the meta-analysis. The meta-analysis of RCTs regarding mortality, general morbidity, and severe morbidity disclosed a tendency towards better results for PRA, which was not statistically significant. Additionally, a lower rate of non-reversion of the ostomy, general reversal-related morbidity, and severe reversal-related morbidity was found in the PRA group (13).

Laparoscopic sigmoidectomy for diverticulitis has been widely used for elective procedures. In patients with diffuse peritonitis due to perforated diverticulitis, laparoscopic sigmoidectomy is feasible in physiologically stable patients only if technical skills and equipment are available. Laparoscopic lavage and drainage have been debated in recent years as an alternative to colonic resection in patients with diffuse peritonitis due to perforated diverticulitis as it has the potential benefit of avoiding a stoma in such patients. Compared with PRA, laparoscopic lavage in Hinchey III acute diverticulitis displayed comparable mortality; however, it was linked with a failure rate with a significantly increased need for reoperation due to the failure of the treatment and to intra-abdominal abscess formation. Long-term mortality and morbidity showed no difference. Therefore, laparoscopic lavage and drainage should be performed only in very selected patients with generalized peritonitis and should not consider the first-line treatment in patients with diverticular peritonitis (6, 14).

IV. Conclusion

Acute diverticulitis is a prevalent gastrointestinal disease that is associated with significant morbidity and health care costs. The management depends on whether the disease is complicated or uncomplicated. Patients with diffuse peritonitis due to perforated diverticulitis require urgent surgical intervention. Two potential approaches are available: colonic resection with the construction of an end colostomy (Hartmann procedure) and primary resection anastomosis (PRA) with or without diverting loop ileostomy. Several meta-analyses have been conducted to determine which of the two techniques has a more favorable outcome and

compare the benefits between the two forms of treatment. The meta-analysis of observational studies displayed lower mortality and morbidity after PRA than the Hartmann procedure, whereas the meta-analysis of RCTs did not demonstrate any difference in mortality and morbidity between the two approaches. Only in one meta-analysis, the morbidity was lower after PRA when considering observational studies. During follow-up, all meta-analyses demonstrated that patients undergoing PRA were more likely to be stoma-free and had a lower rate of reversal-related morbidity. Laparoscopic lavage and drainage should be performed only in very selected patients with generalized peritonitis and should not consider the first-line treatment in patients with diverticular peritonitis.

Abbreviations:

PRA: Primary resection anastomosis.

RCTs: Randomized Controlled Trials.

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Author contribution:

1. Tepelenis N: Study conception and design, drafting of manuscript.
2. Stefanou SK: Study conception and design, drafting of manuscript.
3. Stefanou CK: Literature search and acquisition of data.
4. Tepelenis k: Literature search and acquisition of data.
5. Kefala MA: Analysis and interpretation of data.
6. Tsoumanis P: Analysis and interpretation of data.
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